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Editor: H. G. Hass. Managing Editor: J. R. Madison. Contributors to this issue: S. S. English, V. R. Marcley, B. R. Blankenship, D. R. Hemenway, E. M. Cowdery, R. T. Prescott, E. Evers, W. W. Martin.

Sugarbeets

In the twenties and early thirties, the sugarbeet industry was in a desperate situation. Yields had dropped to a fraction of normal because of widespread infestations of curly-top disease.

Factories were closing—some actually torn down—because there were few or no sugarbeets to process. The economic impact of shutdowns spread through many communities, reached into thousands of homes—rural and urban. Many people thought the sugarbeet industry was done for in this country.

At this critical juncture, agriculture scientists came through by developing sugarbeet varieties resistant to curly top. With these varieties the industry recovered rapidly to become the thriving one it is today.

Another important research achievement of the past 10 years was the development of the monogerm sugarbeet. The full impact of this development is still to be felt, although growers are planting more monogerm seeds each year.

Engineering research on mechanical harvesting has eliminated a labor bottleneck—through new machinery for topping and harvesting beets.

The discovery of male sterility in sugarbeets has been very useful in production of hybrid seed. Yields of hybrids are about 15 percent better than those of open-pollinated.

Nematode-resistant crosses, achieved by chemically rearranging the beet's chromosomes, are another significant result of sugarbeet research. This technique may hold wide application for other crops.

Research has been influential in other areas affecting the sugarbeet industry. Advances have been made in overcoming the soil salinity problem for seedlings; in understanding complex relationships between irrigation schedules and fertility levels to provide good yields without impairing quality; in improving field and cultural practices to exploit the laborsaving potential of monogerm seeds, and in developing techniques for determining monogerm seed properties.

Other complex sugarbeet problems remain to be solved. But like the trying difficulties overcome in the past, they should yield to determined research efforts.

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AGRICULTURAL RESEARCH SERVICE
United States Department of Agriculture

Growth Through Agricultural Progress

INSECTICIDE DOUBLES AS BLOSSOM THINNER

Golden Delicious, Jonathan, Winesap, Delicious, and Granny Smith were thinned effectively in more than 100 experiments

■ Apple blossoms can be thinned efficiently and economically with l-naphthyl N-methylcarbamate (Sevin), a chemical now recommended as an insecticide, USDA studies show.

In more than 100 tests, Sevin was consistently effective in thinning five major varieties—hard-to-thin Golden Delicious and Jonathan and easily thinned Delicious, Winesap, and Granny Smith.

The tests were conducted by ARS horticulturist L. P. Batjer at Wenatchee, Wash., and New South Wales, Australia. Cooperating were Washington Agricultural Experiment Stations, Union Carbide Co., and Bathurst Experiment Farm, N.S.W. In the Australian tests, Batjer was assisted by B. J. Thomas and F. E. Hazlewood of Union Carbide Australia Limited and W. J. Greenhalgh of the Bathurst farm.

Because of its low toxicity to warm-blooded animals, Sevin is considered a valuable insecticide for use on food and feed crops. This safety factor, added to Sevin's unusual reliability as an apple-blossom

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BLOSSOM THINNER

(*Continued*)

thinner, makes it especially promising for use by growers. (Sevin has not yet been registered for use as a blossom thinner, and cannot be recommended until such registration has been granted.)

The blossom-thinning property of Sevin was first observed in 1958, when the chemical was tested against the codling moth in central Washington. Applied at the rate of 1½ pounds per 100 gallons of water at first cover stage (15 to 20 days after full bloom), Sevin not only controlled the moth but also reduced fruit set of Delicious and Winesap apples.

Uniform thinning in first tests encouraged more studies

In 1959 Batjer evaluated Sevin as a thinner of Delicious blossoms. Sevin caused substantial thinning, without overthinning, in six Washington tests. Uniformity of results was outstanding.

Batjer then tested Sevin on additional apple varieties. He compared it with naphthaleneacetic acid (NAA), naphthalene acetamide (NAD), and the sodium salt of dinitro-ortho-cresol (DNOC). These are the principal thinning chemicals now used in the Northwest.

Observations were also made of the relationships between timing and concentrations of the sprays and degrees of thinning; effects on growth, harvest drop, size, and seed content of fruit; and amount of bloom produced by sprayed trees the following year.

The studies in Australia in the fall (spring there) of 1959 and 1960, and in Washington in the spring of 1960, showed Sevin to be equally effective: (1) When applied to Delicious, Golden Delicious, Jonathan, Winesap, and Granny Smith varieties (Granny Smith is widely grown in Australia); (2) on Delicious in concentrations ranging from ¾ pound to 1½ pounds per 100 gallons of water, and on the other varieties in concentrations ranging from 1½ to 3 pounds per 100 gallons of water; and (3) when the chemical was applied any time between 15 and 25 days after full bloom.

NAA and NAD, applied at recommended rates and times, failed to thin significantly in three experiments. DNOC failed in one experiment. Although substantial thinning was accomplished, the amount of thinning varied among different experimental blocks of trees.

Batjer says these results suggest that Sevin may be less sensitive to environmental conditions than thinning chemicals now available. If so, sprays containing Sevin would be easier to apply, and more reliable in thinning apple blossoms.

Sevin reduced the number of seeds in Delicious apples but had little or no effect on seed content of the other varieties. Commercial thinners didn't reduce seed numbers in any of the varieties tested. Despite their lower seed content, Sevin-treated Delicious apples matured normally. The amount of harvest drop and malformed fruit was no greater than usual.

Blooming increased the year after thinning in Australia

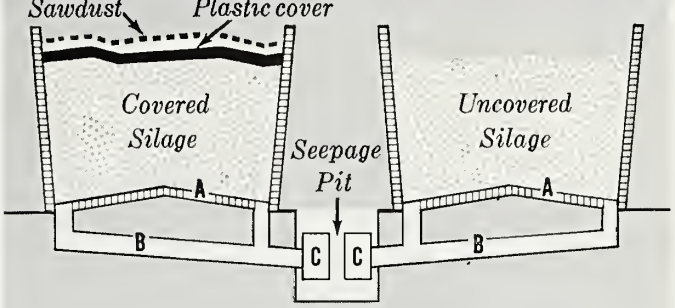
In the Australian studies, all trees thinned in 1959 produced heavier bloom in 1960 than unthinned trees. On Sevin-treated trees, the increase in amount of bloom was closely associated with degree of thinning in 1959—but not with timing of applications.

With the exception of Delicious, relationships between reduced fruit set in 1959 and amount of 1960 bloom were similar, regardless of the time Sevin was applied. Applications to Delicious 15 and 25 days after full bloom resulted in the same degree of set reduction. But the 1960 bloom was considerably greater on trees that received the 15-day treatment.

Earlier studies suggested that NAA promotes flowerbud initiation (AGR. RES., March 1959, p. 3). But Batjer says NAA-treated trees in his experiments had no greater bloom the year following treatment than trees treated with Sevin. This suggests that in both cases the heavier bloom, compared to untreated trees, was an indirect effect of thinning rather than a direct effect of the chemical treatments.

Apples from Sevin-treated trees were slightly smaller than those from trees treated with DNOC, but were significantly larger than those from trees thinned with NAA and NAD.☆

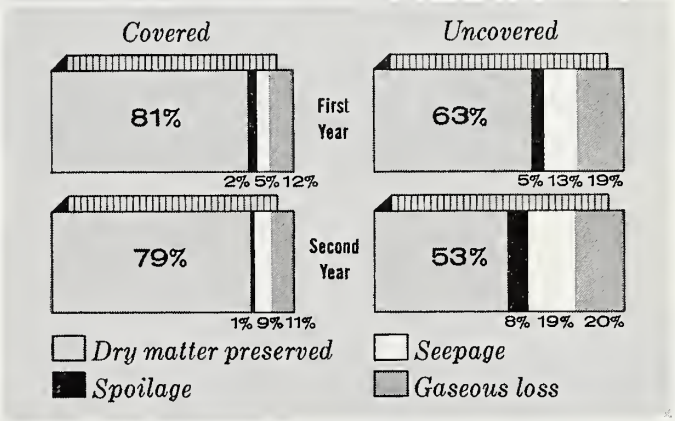
Uniform high-quality fruit was set by hard-to-thin Golden Delicious variety treated with Sevin.



Liquid losses are measured by metering devices (C) in seepage pit. Underground pipes (B) drain seepage from inclined concrete floors (A) of bunker.

BUNKER SILO COVERS SAVE FEED

Use of a seal results in much less spoilage, seepage, and gaseous loss, research shows



Two-year tests show sealed bunker preserves feed better than unsealed one. Spoilage accounted for minor part of total losses.

■ Plastic covers that seal bunker silos reduce feed losses much more than might be indicated by comparing the spoilage layers in these silos with those in unsealed bunkers.

More significant—but less obvious—is the reduction, made possible by use of plastic covers, in silage losses caused by seepage and by gas. The latter is an invisible loss not due to spoilage or seepage.

In addition to only about half as much silage spoilage, a sealed bunker at USDA's Agricultural Research Center, Beltsville, Md., had less than half the seepage and gas losses of a comparable unsealed bunker.

Visible spoilage in sealed and unsealed bunkers actually accounted for about one-seventh the total dry feed loss in a 2-year experiment led by ARS dairy husbandman C. H. Gordon and agricultural engineer J. R. McCalmont. The visible spoilage layer never exceeded 3 inches in thickness, even in the unsealed bunker.

Orchardgrass ensiled in the uncovered bunker lost 37.1 percent of its dry matter, compared to a loss of only 19.1 percent in the sealed one.

In the unsealed bunker the following year, silage made of a mixture of orchardgrass and ladino clover lost 46.9 percent of its dry matter. Dry matter loss in the sealed bunker was 21.3 percent.

Gordon and McCalmont figure the seal saved about 10 pounds of dry matter per square foot of silo surface. This much dry silage is normally worth at least 15 cents. A polyethylene seal 4 millimeters thick costs only about 2 cents per square foot.

On this basis, the cover is worth the money, even if it's used only one season. A more durable experimental material, neoprene-coated nylon that's been tested 6 years, hasn't been assigned a yearly cost because it's still in good condition.

Had visible spoilage been the only criterion for judging the value of the seals, however, the covers wouldn't have appeared economical.

Much of the higher seepage loss from the uncovered bunker was due to moisture from rain and snow filtering through the silage. Precipitation leached nutrients out.

On the other hand, seepage measurements from the sealed bunker revealed that silage juices accounted for the only moisture loss.

The sealed bunker saved more feed and produced better silage. Feed from the sealed bunker was preferred by dairy cattle. They produced more milk and lost less weight than cattle fed from the unsealed bunker.

Seals used in the study were anchored to the surface of the silage by covering with 3 inches of sawdust.☆

DISTRIBUTING GRANULES EFFICIENTLY BY PLANE

Currents from the wing, or the airfoil, and from the propeller distribute the granules in swaths.

■ Two efficient ways to disperse granular herbicides and insecticides by airplane—from the wing and from a winglike attachment—are being developed by USDA scientists.

A specially equipped low-flying plane harnesses air currents from the wing or the attachment (called an airfoil), and from the propeller, to distribute the pesticide granules. Swaths up to 45 feet wide are easily treated, and there is less variation in pesticide concentration in the swath than when granules are applied from a plane with conventional application equipment.

A conveyor belt in the airfoil moves granules from a hopper in fuselage to opening in airfoil.

Pesticides were applied accurately, in swaths up to 45 feet wide, from the wing or a winglike attachment used in preliminary tests

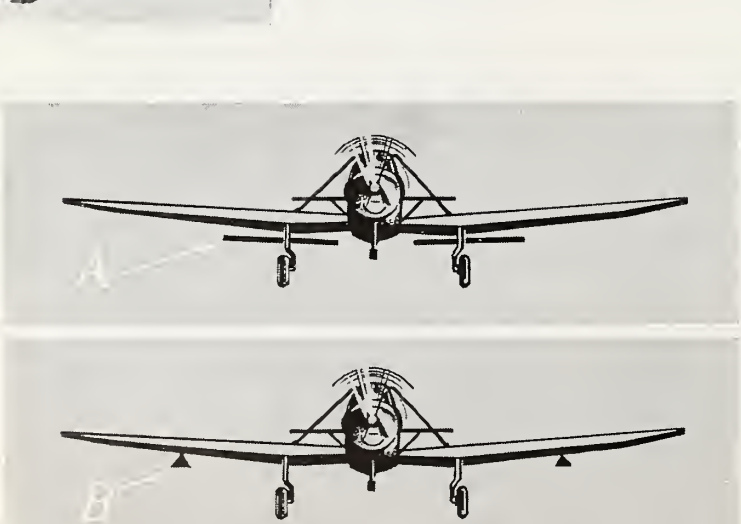
Present and new methods were compared

This was determined in preliminary work at Forest Grove, Oreg., by agricultural engineer V. D. Young and entomologist C. E. Deonier of ARS. They compared conventional methods of applying granules with the new techniques.

Experiments to improve conventional application methods began with the airfoil attachment installed beneath the fuselage of a high-wing plane and under the wing of a low-wing plane. Use of the airfoil created little drag on the forward motion of the plane and resulted in even distribution of granules.

As the granules were released further from the center of the airfoil. the swath made by the fallen particles became wider. But releasing granules from the ends of the airfoil produced a swath of only 28 to 30 feet.

To determine if use of a longer



Airfoil (above) produced swath of 28 to 30 feet. Use of the wing (below) widened swath to 45 feet. Approximate points of release are shown by A and B.

winglike distributor could produce a wider swath and provide even distribution and little drag, the scientists tried releasing granules from small hoppers mounted on the wing.

Best results were obtained by releasing granules about 9 feet from the center of the plane. At this point, the granules were spread evenly in a swath 40 to 45 feet wide.

One of the conventional distributors also created a swath of 40 to 45 feet. But concentration of granules released from this distributor was less uniform than when granules were released from the wing. Also, the shape of the conventional distributor caused considerable drag.

Conventional systems generally move granules from a hopper in the fuselage into an airstream produced by an airscoop in the underside of the plane. The granules are then dispersed through ducts, extending back under the wing, primarily into the propeller airstream.

Currents from wingtips may have helped

Superior performance of the wing distributor may be due partly to air currents from the wingtips. These currents supplement air blown back from the propeller.

Conventional distributors were first designed to apply dusts (ground crystals), not granules. However, granules drift less and fall more uniformly than dusts and sprays. Reduced drifting is an important safety factor in the use of toxic chemicals.

Young and Deonier are developing equipment to convey granules for release through the wing and from a larger airfoil. This equipment is being designed to disperse granules at a wide range of rates.☆

What Attracts

Mosquitoes?

■ Why do mosquitoes bother some people and leave others alone? There's no simple answer. Entomologists know that many things affect the way mosquitoes are attracted to man and animals.

A prominent Canadian entomologist recently remarked, only partly in jest, that a cool, moist-skinned, pale, motionless man in a white suit could avoid all annoyance from mosquitoes by not breathing.

It is hoped that basic studies will uncover primary reasons why mosquitoes—and other insects—are attracted. This would speed development of more effective repellents, baits, and insecticides.

Experiments by ARS entomologists C. N. Smith, I. H. Gilbert, and H. K. Gouck at USDA's insect laboratory in Orlando, Fla., illustrate the complexity of this type of research.

The researchers dressed a man in a lightweight diving suit that kept water vapor, carbon dioxide, and other gases from escaping to the surrounding environment. He was placed in a small observation room with three man-size dummies and 300 mosquitoes. The subject's breath was drawn outside the room through a hose.

Mosquitoes showed no preference between the man and the dummies. When CO_2 was discharged (from a tank at rates about equal to normal exhalation) above the man's head, however, he attracted more mosquitoes. The pests also were attracted when a cloth suit was put over the man's diving suit—regardless of the presence or absence of CO_2.

Researchers exposed the man's face—no increased attraction. But when his hands were uncovered, the mosquitoes were attracted.

These mosquitoes, *Aedes aegypti* (L.), prefer the body. Another group (*Aedes taeniorhynchus*) is lured more to the face than the hands.

This shows that different types of mosquitoes aren't necessarily attracted to man and animals for the same reasons. Other insects don't respond alike, either. For instance, in one study entomologists observed that horse flies preferred red cattle to white ones. Stable flies showed little preference between red or white breeds—but, like horse flies, the pests were most attracted to black cattle.

More specific information on fundamental reasons for insect attraction is needed. If scientists can find precise causes, more effective repellents that would mask the attraction might be developed.

Attraction-retarding materials might be combined with insecticides. There would be fewer insects bothering treated individuals. And the most persistent pests could be killed by the insecticides.

Such information might also lead to more effective baits for luring and trapping insects.☆

Adult predator mite (top) attacking adult two-spotted spider mite. Predators also feed on eggs and immature spider mites.

In the greenhouse

PREDATORS VERSUS SPIDER MITES

Two mites that attack the two-spotted spider mite may give better control of this tiny pest

■ Better control of the two-spotted spider mite—a very destructive pest that attacks almost all crops grown in greenhouses—may result from research by USDA entomologists.

A team headed by F. F. Smith is studying the use of predator mites to kill populations of this spider mite, *Tetranychus telarius*.

The entomologists are most optimistic about the performance of two predator mites—*Typhlodromus*, a native of the United States, and *Phytoseiulus*, imported from West Germany—which have been released experimentally to prey on populations of the two-spotted spider mite. Both predators devour the eggs, the immature spider mites, and the adults. In preliminary studies at the Agricultural Research Center, Beltsville, Md., use of these predators for spider mite control has been very successful.

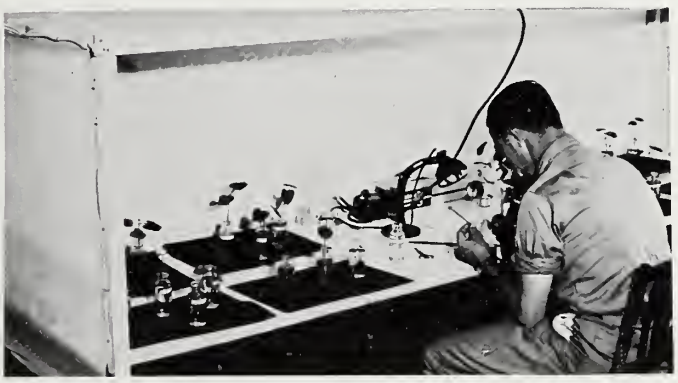
Chemical sprays and fumigants employed since 1948 are no longer able to protect greenhouse plants from the two-spotted spider mite. Use of these materials has eliminated susceptible spider mites and left strains resistant to the chemicals.

These resistant mites multiply rapidly in the high temperatures common in greenhouses. The pests complete a life cycle (one generation) in 8 to 12 days. By inbreeding, they tend to develop homogeneous resistant strains. This mite is able to pass on its resistance to its progeny—even though many generations of offspring may never contact chemicals.

The two predators have *not* acquired similar resistance, but studies show that each species *can* tolerate many of the chemicals used against other pests and diseases in greenhouses. The entomologists, however, are attempting

Adults of two-spotted spider mite attack almost all greenhouse crops. Many strains of mites have become resistant to all the chemicals that have been giving satisfactory control.

Tiny predator mite eggs have been laid on most of surface of this leaf. Note the two predator mite nymphs and eggs.

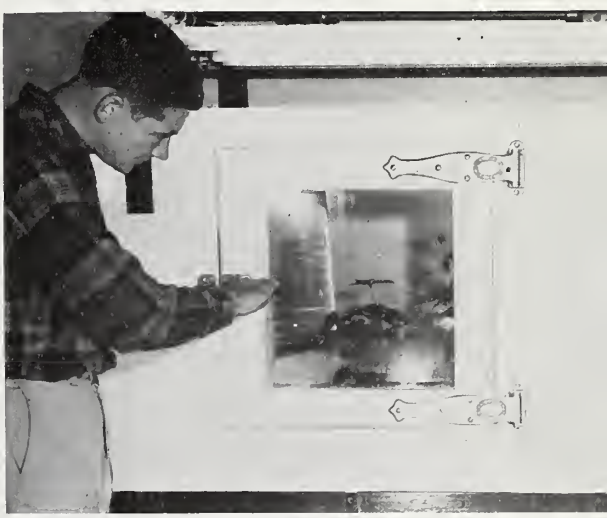


In attempting to select pesticides they will tolerate, A. L. Boswell places predator mites on bean plants treated with various chemicals.

to combine use of chemicals with predator control. Careful selection of chemicals for use against other greenhouse pests and diseases can prevent damage to the predators, so they can continue attacking the resistant spider mites.

When the predators exhaust their food supply, they become cannibalistic. Consequently, they must be released anew each year. Smith intends trying to stockpile the predators by keeping them dormant in cold storage, ready for use as needed.

The researchers are also investigating an artificial diet, including pollen and honey, for mass rearing of the predator mites. Much time, space, and labor now needed in growing plants and spider mites as feed for the predators will be saved if an artificial diet can be developed and used successfully. ☆



This controlled environment chamber is used to rear predator mites on plants infested with two-spotted spider mites.

More roots—more top growth, better all-round performance from timely plant feedings

Fertilized Range Plants Drink Deep

McKell in mid-March compares plant growth, after cool winter, in fertilized (left) and unfertilized plots.

■ Fertilized annual range plants develop strong, vigorous roots needed to extract deep-down soil moisture that otherwise is used by summer-growing weeds.

Recent USDA-California studies showed that plants treated with moderately high applications of nitrogen and phosphorus produced a more extensive root system and used moisture four times more efficiently than untreated plants. The fertilized plants, using the extra nutrients and moisture, produced more luxuriant growth, matured earlier, and eliminated competition from annual weeds.

Under range conditions like those in California, this would mean more high-quality green feed for late winter and spring grazing, as well as additional dry feed for use during the hot, dry summer and fall, when grasses normally do not grow. California alone contains about 18 million acres of annual rangelands, which provide most of the forage used by livestock in that State. This forage consists primarily of annual grasses, legumes, and other native plants that start from seed each year.

Earlier research indicated that amount and distribution of moisture throughout the growing season are critical factors in plant growth on these rangelands. Their effects may be significantly altered by the application of fertilizer.

As an aid in developing improved range practices, studies were begun in 1956 to determine affects of fertilization on depletion of soil moisture and on yields of forage. An experimental area was selected on the west slope of the Sacramento Valley, where the average rainfall of 18 to 20 inches usually occurs between September and May.

Researchers were plant physiologist C. M. McKell of ARS, and botanist Jack Major and laboratory technician E. R. Perrier of the California Agricultural Experiment Station.

Plots were treated before autumn rains

Fertilizer treatments, applied before the first fall rain, included 150 pounds of nitrogen per acre, 200 pounds of phosphorus, and 150 pounds of nitrogen plus 200 pounds of phosphorus. Plots with no added fertilizer were used as controls. Soil moisture and plant growth and development were recorded periodically, and forage yields were measured by sampling at peak growth.

Plants on plots treated with nitrogen and nitrogen plus phosphorus responded sooner to the first rain and grew faster during the winter months than plants treated with phosphorus or with no added fertilizer.

This increased growth, however, did not drain the moisture reserve from the soil. Early in March, all plots had moisture at field capacity, even though the nitrogen and nitrogen-phosphorus plots were supporting luxuriant stands of annual forages.

As spring temperatures rose, plants on all plots began using soil-moisture reserves. However, the nitrogen- and nitrogen-phosphorus-treated plants reduced the moisture below field capacity earlier and continued using it at a higher rate. By early May, plants

with roots at depths of 6, 12, and 20 inches had wilted.

A rain on May 20 was not used by nitrogen - phosphorus - treated plants, because they were mature and dry.

On the nitrogen plots, this rain was used by some plants in the final stages of maturity. No summer-growing annual weeds were observed on any of these plots. But on the phosphorus and nonfertilized plots there were many green weeds that continued to deplete soil moisture until they matured in late June and July.

Excavated soil columns 20 inches in depth showed that roots in the nonfertilized plots were abundant at the surface of the soil, but hardly any penetrated 20 inches. In contrast, roots in the nitrogen-phosphorus plots were uniformly abundant at the 20-inch depth. Many roots were severed when the soil columns were removed, and moisture depletion at 36 inches indicated some of these roots penetrated at least to that depth.

Best yield was 5,929 pounds per acre

Yields on the nitrogen-phosphorus plots averaged 5,929 pounds of forage per acre. This was more than four times the 1,440 pounds produced on the nonfertilized plots. The nitrogen plots yielded 3,169 pounds, or twice the yield on the plots with no fertilizer. The phosphorus plots produced 1,704 pounds of forage per acre—less than one-fifth more than the nonfertilized plots.

There were close relationships between fertilizer and moisture use, as measured by forage yield per inch of rain (October–June). Plots with nitrogen plus phosphorus averaged 348.6 pounds of forage per inch of rainfall: with nitrogen, 186.3 pounds; and with phosphorus, 100.2 pounds.

Plots with no added fertilizer averaged 84.7 pounds of forage per inch of rainfall, only about one-fourth of the best yield.☆

Increasing Forage Seed for Other Countries

■ U.S. farmers last year increased seed of 21 foreign forage varieties for seven overseas countries—and this is considered just a healthy start toward expanded markets for our export production.

As more countries learn of the high-quality seeds we produce, more will likely become interested in having their varieties increased here for export back to them.

Western producers, because of favorable growing conditions, rigorous production standards, and advanced seed technology, are able to obtain high yields of superior quality seeds. Foreign Agricultural Service observers say U.S.-increased German alfalfa varieties perform well in Germany. In growing trials there last summer, German alfalfas increased in California grew into more vigorous plants than plants from seed of the same varieties grown in Germany.

An increasing number of acres in the United States being used for this purpose is the result of seed production research by ARS, in cooperation with State agricultural experiment stations, Foreign Agricultural Service, governments and producers in the countries involved, and the domestic seed industry.

For example, cooperative research by USDA and Finland in 1956 and 1957 showed that seed of red and alsike clover varieties developed in Finland could be increased here. First-generation seed produced in California, Montana, and Washington was sent to Finland and compared with the original seed produced there. There were only slight, insignificant differences between plants from U.S.-produced seed and those from seed grown in Finland.

As a result, farmers in Oregon and Washington used 250 acres to increase seed of Finland's clover varieties for export in 1961. All acreage was contracted between United States and Finland seed firms.

Similarly, California producers grew about 1,500 acres of alfalfa varieties from Germany for export there in 1960—about a fourth of that country's annual alfalfa seed import requirement. Western producers have also increased seed of varieties from Sweden, Great Britain, the Netherlands, and France.

Prior to the research, many overseas seedsmen and scientists were reluctant to have plant varieties increased here. They believed (some still do) that varietal characteristics might change if seeds were increased outside the area of adaptation.

The USDA-Finland research—led by ARS agronomist C. S. Garrison and Finland agronomist Otto Valle—shows that Finland clover varieties undergo little change by being increased in the West. There *is* a limit, however, to the number of generations seed may be increased without noticeable change. So fields must be reseeded with foundation seed from originating countries at regular intervals.

The research is continuing. Scientists don't have all the answers regarding the maintenance of varietal purity. Nor do they know which foreign varieties we can produce economically for seed.☆

Damage to Hinodegiri azaleas (left) and Mathotiana camellias increased as soil salinity levels rose. Plants 1 and 2 survived salt levels below 1,800 ppm. Higher levels killed plants 3, 4, and 5.

Azaleas and Camellias can't take much salt

Soil salinity tests can aid growers in keeping these plants healthy

■ Azaleas and camellias can't tolerate high soil salinity, even though they grow best in the acid soils and temperate climate of our Eastern and Gulf Coast areas, USDA-Virginia studies show.

Salt levels above 1,800 parts per million in the soil solution were fatal to azalea and camellia plants grown in greenhouse tests at the Virginia Truck Experiment Station, Norfolk. (In contrast, corn can tolerate salt levels of 4,000 ppm and cotton 6,500 ppm. Sea water contains about 35,000 ppm of salt.)

The studies were conducted by soil scientists J. Lunin of ARS and F. B. Stewart of the Virginia station, in response to requests from growers for help in preventing damage from excess soil salinity.

Azaleas and camellias are fast attaining top popularity among homeowners and community improvement groups. Extensive plantings represent a sizable investment, and severe losses may result from coastal flooding or salt spray carried inland by wind. Brackish irrigation water or large amounts of fertilizer can also cause excess soil salinity.

In the tests, 2-year-old Hinodegiri azaleas and Victor Emmanuel and Mathotiana camellias received four 1-inch irrigations. The researchers used synthetic sea water containing 640, 1,280, 2,560, and 3,840 ppm of salt, applied during a 5-week period. A control group of plants received demineralized water only.

Injury showed soon after salt treatments

Within a week after the last saline irrigation (April 1), azaleas receiving the highest concentration of salt showed browning of tips on almost all leaves. Older leaves dried and dropped off. The next-to-highest salt concentration caused tipburn on 25 to 50 percent of the leaves, but no defoliation occurred.

Visible symptoms on the camellias were less severe. At the highest salt concentration, older leaves had tipburn and soon dried and dropped, but only an occasional young leaf was affected. Mathotiana showed more injury than the Victor Emmanuel.

By May 1, all of the azaleas and camellias that received the highest salt concentration were dead. The azaleas still had most of their leaves, but the camellias were completely defoliated. Plants that received the next-to-highest concentration showed severe injury and 2 weeks later were dead also.

These findings indicate that 1,800 ppm of salt in the soil solution is the upper limit permissible for azaleas and camellias. If coastal flooding or high ocean winds occur, the scientists recommend that soil salinity tests be made to determine whether salt must be leached out to prevent damage. And soil salinity should be checked when brackish water is used for irrigation, or when fertilizer applications are heavy.

Growers who wish to have soil salinity tests made should consult their county agricultural agent or send a soil sample to their State soil testing laboratory.☆

IRON IN WASH WATER CAUSES EGG SPOILAGE

■ Washing eggs in water of comparatively high iron content—5 to 10 parts per million—increases the rate and extent of spoilage.

This discovery by ARS researchers can help egg producers and processors reduce serious egg spoilage that often occurs. For example, approximately $20 million is lost annually due to spoilage of shell eggs (eggs sold fresh).

Research shows that iron present in wash water can reverse the protective action of an egg's conalbumin—the iron-binding protein found in egg white. Earlier studies showed that conalbumin normally protects eggs from the *Pseudomonas* family of bacteria. These bacteria are known to be a prevalent cause of spoilage. Conalbumin chemically binds naturally occurring iron, making it unavailable to these micro-organisms that need it for growth.

Scientists have known for many years that washing eggs increases risk of spoilage. But, due to lack of basic knowledge about factors in eggs controlling bacterial growth, the scientists could not agree on how to avoid spoilage. Common practice on most egg farms is to machine-wash all eggs—not just dirty ones—to eliminate time-consuming sorting.

The detrimental effect of excess iron was revealed in laboratory studies by chemist J. A. Garibaldi and bacteriologist H. G. Bayne at USDA's Western utilization laboratory, Albany, Calif. Earlier, Garibaldi reported the importance of conalbumin in protecting eggs against spoilage.

Bacteria used in the tests—*Pseudomonas fluorescens* and *Pseudomonas ovalis*—caused spoilage known as fluorescent sour in shell eggs. (Eggs were infected by immersion in a bacteria-iron solution.) By candling the eggs with ultraviolet lamps, this type of spoilage was identified by the bright, blue-green fluorescent pigments excreted by the bacteria during growth.

Field tests at several egg farms confirmed the laboratory findings. At one farm, spoilage was slight—1 percent or less—in eggs washed in well water containing less than 1 ppm of soluble iron. However, at another farm, spoilage amounted to 6 percent a few weeks after eggs were washed in well water containing 5 to 10 ppm of iron.☆

ROACH COULD AID U.S. SPACE STUDIES

■ The Madeira roach has characteristics that could make it useful for biological studies of the effects of outer space on life, according to USDA scientists.

This extremely hardy roach is lightweight and requires less air and food than organisms of a higher order. It can also withstand radiation and multiple g's (acceleration force) much better than mammals.

These are reasons why ARS entomologists feel there could be advantages in utilizing the roach in satellites and space vehicles where more sensitive organisms might perish.

The scientists recently concluded laboratory experiments, using the Madeira roach, *Leucophaea maderae* (F.). The researchers wanted to determine the most suitable atmosphere for the insect sealed in a 12-ounce metal container. Such a container could house the insect in a space craft. For the tests, the entomologists devised systems whereby an electrophysiological signal could be obtained from the enclosed roach and telemetered back to earth.

The experiments show that the most favorable atmosphere for survival of the roach is 55 to 58 percent oxygen and 42 to 45 percent nitrogen. Man on earth lives in a combination of about 21 percent oxygen and 78 percent nitrogen.☆

Roach was mounted this way before being put in a container. Method could be used in space studies.

Diseased bee larvae are removed from comb for inspection. These larvae are infested with American foulbrood disease. Effect of drug is checked by injecting (below) minute dose into diseased larva.

ANTIBIOTICS COMBAT BEE DISEASES

Timely treatment helps control outbreaks that might otherwise spread and increase losses

■ Antibiotics are being used to protect honeybees—key workers in the $50 million honey and beeswax industries—from attacks of disease.

Honeybees are susceptible to disease, the same as plants and animals. But because bees live and work together in close-knit communities, disease troubles are often intensified.

Bee diseases have been studied for many years. Aristotle published an excellent description of American foulbrood. (The name wasn't the same but the disease was.) Virgil prescribed a treatment for the disease. It remains, however, the most serious ailment affecting bees.

Our researchers find antibiotics effective in controlling outbreaks of American foulbrood and other bee diseases. Many different antibiotics are available for such use.

Adult bees assist in controlling American foulbrood, a larval disease, by feeding antibiotics to the larvae. The adult honeybees are first fed sugar sirup containing sulfathiazole (0.5 to 1.0 gram per gallon of sirup), or are dusted or sprayed with a powdered sugar-terramycin mixture at the rate of 0.1 to 0.2 gram terramycin per colony.

The larvae eat the antibiotic-containing food supplied by adult bees. The drug then kills disease organisms inside the larvae.

Antibiotics are also used to combat European foulbrood, Nosema disease of adult bees, and other maladies.

Continuing studies are underway

ARS conducts bee disease studies at the Agricultural Research Center, Beltsville, Md., and at Laramie, Wyo., and Madison, Wis., where entomologists seek better ways to control prevailing diseases. Scientists also study foreign ailments that might affect domestic bees. In addition, a disease-diagnosis service is maintained. It provides positive identification needed for effective field control of bee diseases.

Beekeepers treating their colonies with antibiotics are better able to control disease outbreaks and prevent spread to unaffected hives. Colonies are treated in the spring, at least a month prior to the bees' production of market honey. Timely application at recommended rates assures the production of pure honey and keeps bees healthy.

Financial losses from bee diseases are hard to calculate because of the insects' inestimable value as pollinators of more than 50 agricultural crops. However, amounts spent for control of American foulbrood might be indicative.

In 1959, 17 States spent $500,000 on apiary inspection for control of foulbrood. Colonies destroyed, because of State law enforcement, were valued at more than $300,000.☆

More chances for plant pest entry

There were more than 160 million chances for destructive foreign pests of plants to enter this country last year. USDA plant quarantine officials estimate.

That's about the number of times people crossed borders into the United States in 1960. More travel expected this year means we'll have a bigger job keeping out insects and diseases that threaten our agriculture.

Unwanted pests are kept out of the United States mainly by ARS Plant Quarantine Division inspectors.

They averaged interception of a potentially destructive plant pest every 17 minutes last year.

But this vigilance doesn't assure there won't be any accidental introductions. Efficient as our inspection and quarantine system is, some pests may enter undetected.

For that reason, plant quarantine officials urge that all people in agriculture report the presence of any unusual insects or plant diseases to a county agent or other local agricultural leader. Vacation travel during the summer increases the need for careful checking.

Farm fire losses dropped in '60

Farm fires caused losses estimated at $165 million during 1960. This is about 5 percent less than the estimated 1959 loss of $174 million, the highest on record.

USDA agricultural economists base their 1960 estimate on reports from 207 farmers' mutual fire insurance companies, selected from 1,625 such firms insuring farm risks.

The loss rate for 1960, including lightning damage not always resulting in fire, averaged 14.2 cents per $100 of insurance in force at the end of the year. This compared with a rate of 14.8 cents for 1959.

Building losses were about 65 percent of total loss payments by companies for which a breakdown by property class was available. Almost three-fourths of the building losses were on main buildings—dwellings and barns. About 81 percent of the aggregate loss payments resulted from fire and about 19 percent from lightning.

Personal property losses were about 35 percent of the total. Livestock losses, about 15 percent of all claims paid, accounted for more dollars than any other personal property item. Most livestock claims were due to lightning.

Frees young trees of peach borer

DDT, long useful for controlling the peach tree borer in bearing orchards and home plantings, also has proved valuable for protecting peach nursery stock against the insect.

In recent experiments, a USDA scientist obtained *complete* control of the borer by applying four sprays of DDT during summer and fall. One experimental spray of dieldrin on the trunks of 1- and 2-year-old nursery trees gave results nearly as good, reports ARS entomologist O. I. Snapp, working at Fort Valley, Ga.

This borer is a major pest wherever peaches are grown—from the Rocky

Mountains eastward, and in certain localities in Pacific Coast States. The borer feeds at or below ground line on living wood of peach trees of all ages. When abundant, the pest may girdle and kill a tree in a year or two. Borer-injured nursery stock is unsalable.

DDT (8 pounds of 50 percent wettable powder per 100 gallons of water) was hand-sprayed on 1-year-old peach trees on July 12, August 9, September 14, and October 9. When these trees were dug the next spring, none were infested. The rate of borer infestation on an untreated plot was 11.5 percent.

In the same series of experiments, 1- and 2-year-old trees were sprayed with 6 pounds of 50 percent wettable dieldrin per 100 gallons of water on August 1. Treated year-old trees showed 0.8 percent infestation, compared with 30.1 percent infestation in an untreated plot.

Two-year-old nursery trees (protected the first season with DDT and the second with dieldrin) had 2.4 percent borer infestation the next spring. Infestation of unsprayed 2-year-old trees was 41.7 percent.

Systemics kept aphids off lilies

Field-grown lilies were protected from aphid attack all season by granular systemic insecticides applied over the bulbs after they were planted in the furrow—but before they were covered—in USDA experiments in Oregon.

Practically no aphids were found on lilies grown in treated soil, although nearby plants in untreated soil were densely infested. Aphids cause serious injury by feeding on the plants. The pest also spreads plant disease viruses.

The most effective chemical was Di-Syston^{R} (*O,O*-diethyl *S*-2-(ethylthio) ethyl phosphorodithioate), ARS entomologist C. F. Doucette reports.

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Very good results were also obtained with phorate. The chemicals enter the sap stream through the lily roots and are distributed throughout the plant. The protection they give eliminates the expense of later aphicidal sprays or dusts.

The materials tested gave equally good results when mixed with the soil in the bottom of the furrow before the bulbs were set. However, this practice is hazardous when planters set bulbs by hand and come into contact with the toxic chemical. Soaking bulbs in an emulsion of either chemical was not as effective as putting the chemical in the soil.

In this study, the western lily aphid, *Macrosiphum scoliopi* (Essig), the melon aphid, *Aphis gossypii* (Glov.), and the foxglove aphid, *Myzus solani* (Kltb.), were the most numerous species in the lily fields.

New rice released for increase

Seed of Belle Patna, the earliest maturing long-grain rice for Southern areas, was released to certified seedgrowers recently.

In a 3-year test, this rice matured in an average of 108 days from seeding time—about 18 days before the next earliest variety, Century Patna 231. Early maturity is advantageous in irrigated areas to free water for other crops.

For the 3 years, the first harvest of Belle Patna yielded an average of 3,521 pounds of rough rice per acre, compared to 3,849 pounds of Century Patna 231 and 3,555 pounds of Bluebonnet 50.

The new variety exhibited high processing and cooking qualities in station and industry tests.

Interstate trials indicate that Belle Patna is best suited for growth in Texas. The new rice was developed cooperatively by USDA, Texas Agricultural Experiment Station, and Texas Rice Improvement Association.

Lodging of this rice has not been serious except in adverse weather. However, the thin-stemmed plants tend to lodge from late or excessive fertilizer applications. Scientists recommend applying fertilizer during the first 30 days of growth.

This variety resists straighthead disease and shows some tolerance to hoja blanca virus. But under Texas and Louisiana conditions, it is moderately susceptible to blast, a fungus-caused infection that may produce leaf blight.

For satisfactory yields, Belle Patna requires more care than most rice varieties. Its seedling growth is slow and adversely affected by low temper-

atures and excessive or deep irrigation early in the season.

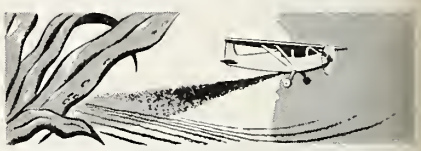
Seed is available to certified growers *only* from the Rice-Pasture Experiment Station, Beaumont, Tex. Seed for farmers will be available early in 1962.

Revised handbook is available

The 1961 revision of USDA's annual handbook on insecticide recommendations has been issued.

This handbook is intended as a guide for entomologists, other research and extension workers, and agricultural associations and agencies that provide information to farmers. Several new insecticides and more efficient dosages of some previously recommended materials are suggested. Specific precautions for use of the insecticides are included.

ARS entomologists stress the need to follow directions and heed pre-



cautions. Users must avoid leaving harmful residues on or in food and feed. They should wear protective clothing when necessary, use special care in handling and applying insecticides, and in handling plants treated with certain chemicals. Insecticides should always be applied so as to minimize losses of honeybees, and to avoid adverse effects on fish and wildlife.

Single copies of "Insecticide Recommendations of the Entomology Research Division for the Control of Insects Attacking Crops and Livestock" (AH 120) may be obtained for 65 cents. Write to Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C.

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